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CHI MEI OPTOELECTRONICS CORP.

Issue Date:Dec.26.2007
Model No.: V470H1-LH3
**Preliminary**

# TFT LCD Approval Specification

# MODEL NO.: V470H1 – LH3

Customer: _____

Approved by:_____

Note:

| | |
|---|---|
| Approved By | TV Head Division |
| | LY Chen |

| | | |
|---|---|---|
| Reviewed By | QRA Dept. | Product Development Div. |
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| | |
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| Prepared By | LCD TV Marketing and Product Management Div. |
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## REVISION HISTORY

| Version | Date | Page (New) | Section | Description |
|---|---|---|---|---|
| Ver.1.0 | Dec, 26,'07 | All | All | Preliminary Specification was first issued. |

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# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

V470H1-LH3 is a 47" TFT Liquid Crystal Display module with 20-CCFL Backlight unit and 4ch-LVDS interface. This module supports 1920 x 1080 Full HDTV format and can display true 1.0G colors (10-bit/color). The inverter module for backlight isn't built-in.

## 1.2 FEATURES

- High brightness (500 nits)
- High contrast ratio (2000:1)
- Fast response time (Gray to gray average 4.0 ms)
- High color saturation (NTSC 72%)
- Full HDTV (1920 x 1080 pixels) resolution, true HDTV format
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Optimized response time for 100 Hz frame rate
- Ultra wide viewing angle : Super MVA technology
- RoHS compliance

## 1.3 APPLICATION

- Standard Living Room TVs.
- Public Display Application.
- Home Theater Application.
- MFM Application.

## 1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 1039.68(H) x 584.82 (V) (47" diagonal) | mm | (1) |
| Bezel Opening Area | 1049 (H) x 593 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1920 x R.G.B. x 1080 | pixel | - |
| Pixel Pitch(Sub Pixel) | 0.5415 (H) x 0.1805 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 1.0G | color | - |
| Display Operation Mode | Transmissive mode / Normally black | - | - |
| Surface Treatment | Anti-Glare coating / 3H | - | (2) |

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) The spec. of the surface treatment is temporarily for this phase. CMO reserves the rights to change this feature.



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### 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal (H) | 1094.5 | 1096.0 | 1097.5 | mm | (1), (2) |
| | Vertical (V) | 638.0 | 640.0 | 641.5 | mm | |
| | Depth (D) | 47.1 | 48.1 | 49.1 | mm | |
| Weight | | - | 14750 | - | g | - |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module Depth does not include connectors.

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## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ELECTRICAL ABSOLUTE RATINGS

#### 2.1.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power Supply Voltage | VCC | -0.3 | 13.2 | V | |
| Logic Input Voltage | VIN | -0.3 | 3.6 | V | |

### 2.2 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | TST | -20 | +60 | ºC | (1) |
| Operating Ambient Temperature | TOP | 0 | 50 | ºC | (1), (2) |
| Shock (Non-Operating) | SNOP | - | 50 | G | (3), (5) |
| Vibration (Non-Operating) | VNOP | - | 1.0 | G | (4), (5) |

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

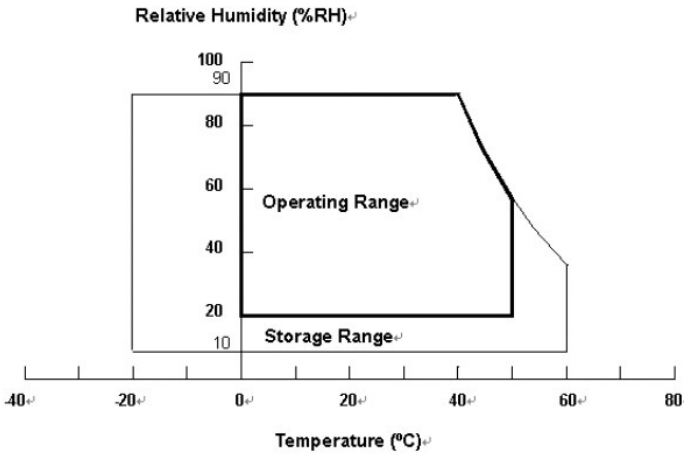
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 ºC with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



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## 2.3 RELIABILITY TEST CONDITION

| No | Test Item | Codition |
|---|---|---|
| 1 | High temperature storage test | Ta = 60℃, 240hrs |
| 2 | Low temperature storage test | Ta = -20℃, 240hrs |
| 3 | High temperature high humidity storage test | Ta = 50℃, 90%RH, 240hrs |
| 4 | High temperature operation test | Ta = 50℃, 240hrs |
| 5 | Low temperature operation test | Ta = 0℃, 240hrs |
| 6 | High temperature high humidity operation test | Ta = 50℃, 80%RH, 240hrs |
| 7 | Vibration test (non-operation) | Wave form: Sine wave<br>Vibration level: 1.0G<br>Fre. range : 10~200Hz<br>Duration: X, Y, Z, 10min,<br>One time each direction |
| 8 | Shock test (non-operation) | Wave form: half sine wave<br>Shock level: 50G<br>±X, ±Y, ± Z, 11ms<br>One time each direction |

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## 3. ELECTRICAL CHARACTERISTICS

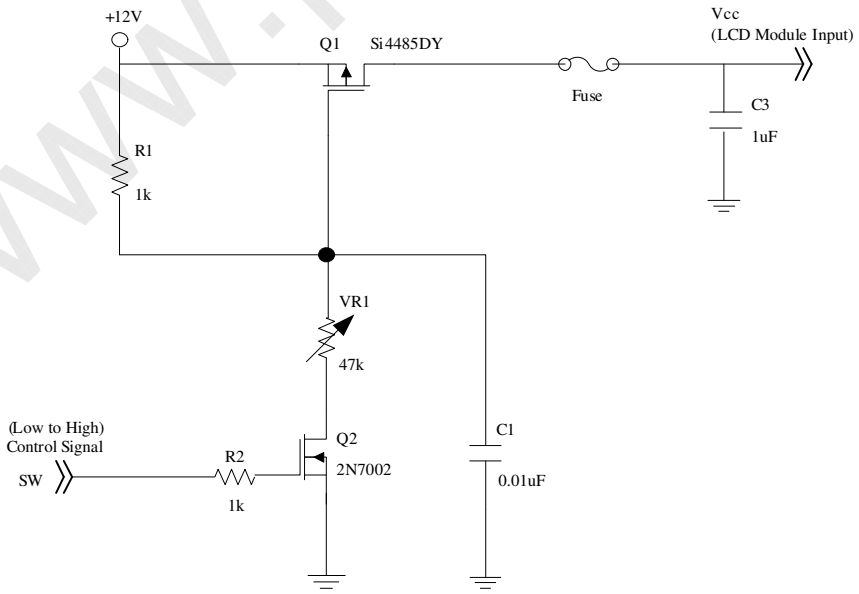
### 3.1 TFT LCD MODULE

(Ta = 25 ± 2 ºC)

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | VCC | 10.8 | 12 | 13.2 | V | (1) |
| Power Supply Ripple Voltage | | VRP | - | - | 350 | mV | |
| Rush Current | | IRUSH | - | - | 7.5 | A | (2) |
| Power Supply Current | White Pattern | - | - | 2.5 | 3.0 | A | (3) |
| | Mosaic Pattern | - | - | 1.5 | - | A | |
| | Black Pattern | - | - | 1.9 | - | A | |
| LVDS Interface | Differential Input High Threshold Voltage | VLVTH | - | - | 100 | mV | |
| | Differential Input Low Threshold Voltage | VLVTL | -100 | - | - | mV | |
| | Common Input Voltage | VLVC | 1.125 | 1.25 | 1.375 | V | |
| | Terminating Resistor | RT | - | 100 | - | ohm | |
| CMOS interface | Input High Threshold Voltage | VIH | 2.7 | - | 3.3 | V | |
| | Input Low Threshold Voltage | VIL | 0 | - | 0.7 | V | |

Note (1) The module should be always operated within the above ranges.

Note (2) The duration of rush current is about 2ms and measurement condition is shown below:



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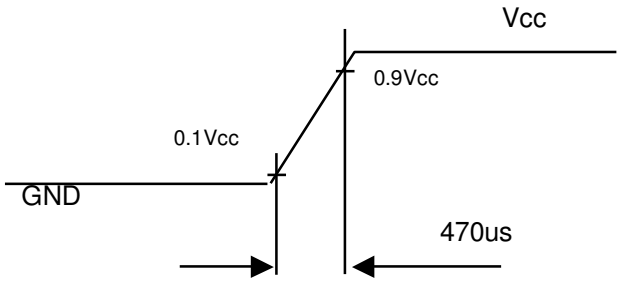
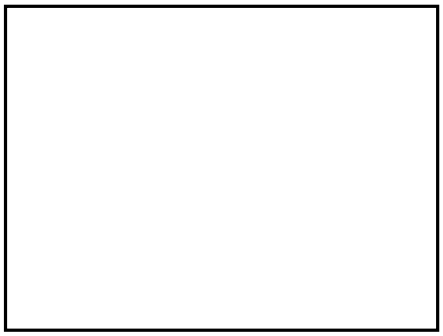
**Vcc rising time is 470us**




Note (3) The specified power supply current is under the conditions at Vcc = 12 V, Ta = 25 ± 2 ºC, $f_v$ =120 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

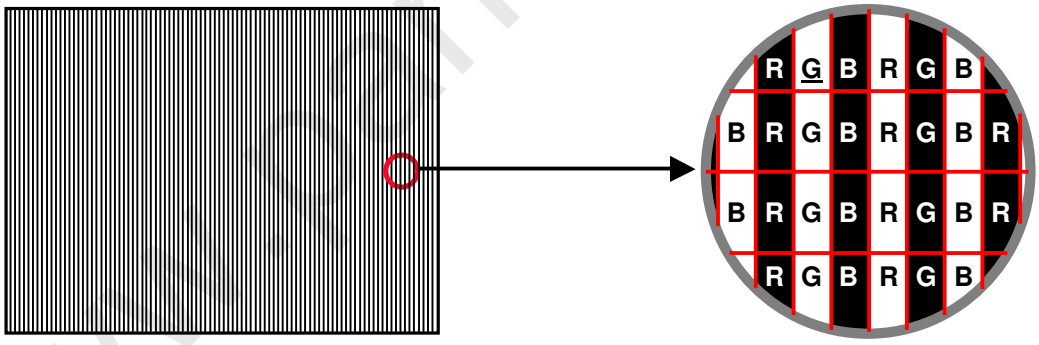


Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern




Active Area

### 3.2 BACKLIGHT CONNECTOR PIN CONFIGURATION

#### 3.2.1 LAMP SPECIFICATION

(Ta = 25 ± 2 ºC)

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Lamp Starting Voltage | VSL | - | - | 2370 | VRMS | Ta = 0 ºC |
| | | - | - | 2160 | VRMS | Ta = 25 ºC |
| Lamp Voltage | VL | 1368 | 1520 | 1672 | VRMS | |
| Lamp Current | IL | 5.5 | 6.0 | 6.5 | mARMS | |



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| | | | | | | |
|---|---|---|---|---|---|---|
| Lamp Frequency | FL | 40 | - | 80 | KHz | |
| Lamp Life Time | LBL | 50,000 | 60,000 | - | Hrs | (1) |

Note(1) Condition: PWM 100% dimming duty ratio

### 3.2.2 ELECTRICAL SPECIFICATION

(Ta = 25 ± 2 ºC)

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| BL Lamp Voltage | VBL | 1032 | 1147 | 1262 | VRMS | (1) |
| BL Lamp Current | IBL | 115 | 125 | 135 | mARMS | 20 lamps |
| Oscillating Frequency | FW | 43 | 45 | 47 | KHz | |
| PWM Dimming Range | PDIM | 20 | - | 100 | % | (2) |
| Striking Time | ST | - | - | 2 | Sec | |
| Lamp Type | - | Straight Type | | | - | |
| Number of Lamps | - | 20 | | | PCS | |
| Type of Current Balance | - | C-Balance | | | - | |
| C Ballaster | CB | - | 22 | - | pF | |

Note (1) Single size: Half lamp voltage + capacitor voltage

Note (2) V470H1-LH3 are designed without Inverter. These items are for reference and based on V470H1-L03 Inverter model.

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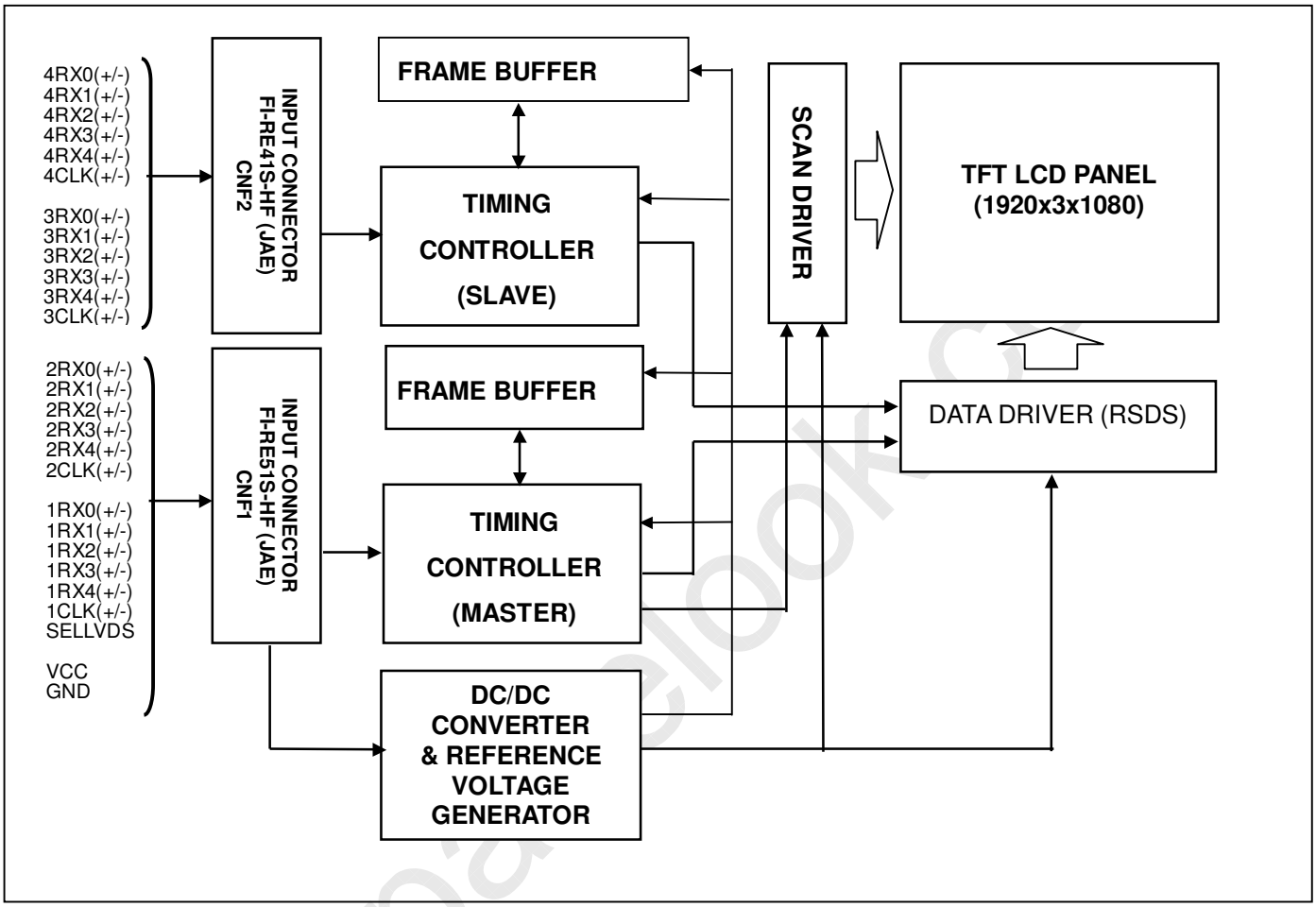
## 4. BLOCK DIAGRAM OF INTERFACE

### 4.1 TFT LCD MODULE



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## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD Module Input

**CNF1 Connector Pin Assignment( FI-RE51S-HF (JAE) or equivalent )**

| Pin | Name | Description | Note |
|---|---|---|---|
| 1 | GND | Ground | |
| 2 | N.C. | No Connection | (1) |
| 3 | N.C. | No Connection | (1) |
| 4 | N.C. | No Connection | (1) |
| 5 | N.C. | No Connection | (1) |
| 6 | N.C. | No Connection | (1) |
| 7 | SELLVDS | LVDS data format Selection | (2) |
| 8 | N.C. | No Connection | (1) |
| 9 | N.C. | No Connection | (1) |
| 10 | N.C. | No Connection | (1) |
| 11 | GND | Ground | |
| 12 | RxAo- | First pixel, Negative LVDS differential data input. Channel 0 | (4) |
| 13 | RxAo+ | First pixel, Positive LVDS differential data input. Channel 0 | |
| 14 | RxBo- | First pixel, Negative LVDS differential data input. Channel 1 | |
| 15 | RxBo+ | First pixel, Positive LVDS differential data input. Channel 1 | |
| 16 | RxCo- | First pixel, Negative LVDS differential data input. Channel 2 | |
| 17 | RxCo+ | First pixel, Positive LVDS differential data input. Channel 2 | |
| 18 | GND | Ground | |
| 19 | RxClko- | First pixel, Negative LVDS differential clock input. | |
| 20 | RxClko+ | First pixel, Positive LVDS differential clock input. | |
| 21 | GND | Ground | |
| 22 | RxDo- | First pixel, Negative LVDS differential data input. Channel 3 | (4) |
| 23 | RxDo+ | First pixel, Positive LVDS differential data input. Channel 3 | |
| 24 | RxEo- | First pixel, Negative LVDS differential data input. Channel 4 | |
| 25 | RxEo+ | First pixel, Positive LVDS differential data input. Channel 4 | |
| 26 | NC | No Connection | (1) |
| 27 | NC | No Connection | (1) |
| 28 | RxAe- | Second pixel, Negative LVDS differential data input. Channel 0 | (4) |
| 29 | RxAe+ | Second pixel, Positive LVDS differential data input. Channel 0 | |
| 30 | RxBe- | Second pixel, Negative LVDS differential data input. Channel 1 | |
| 31 | RxBe+ | Second pixel, Positive LVDS differential data input. Channel 1 | |
| 32 | RxCe- | Second pixel, Negative LVDS differential data input. Channel 2 | |
| 33 | RxCe+ | Second pixel, Positive LVDS differential data input. Channel 2 | |
| 34 | GND | Ground | |
| 35 | RxClke- | Second pixel, Negative LVDS differential clock input. | |
| 36 | RxClke+ | Second pixel, Positive LVDS differential clock input. | |
| 37 | GND | Ground | |
| 38 | RxDe- | Second pixel, Negative LVDS differential data input. Channel 3 | (4) |
| 39 | RxDe+ | Second pixel, Positive LVDS differential data input. Channel 3 | |
| 40 | RxEe- | Second pixel, Negative LVDS differential data input. Channel 4 | |
| 41 | RxEe+ | Second pixel, Positive LVDS differential data input. Channel 4 | |
| 42 | GND | Ground | |
| 43 | GND | Ground | |
| 44 | GND | Ground | |
| 45 | GND | Ground | |
| 46 | GND | Ground | |
| 47 | NC | No Connection | |
| 48 | Vin | Power input (+12V) | |



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| | | | |
|---|---|---|---|
| 49 | Vin | Power input (+12V) | |
| 50 | Vin | Power input (+12V) | |
| 51 | Vin | Power input (+12V) | |

**CNF2 Connector Pin Assignment ( FI-RE41S-HF (JAE) or equivalent )**

| Pin | Name | Description | Note |
|---|---|---|---|
| 1 | GND | Ground | |
| 2 | N.C. | No Connection | (1) |
| 3 | N.C. | No Connection | (1) |
| 4 | N.C. | No Connection | (1) |
| 5 | N.C. | No Connection | (1) |
| 6 | N.C. | No Connection | (1) |
| 7 | NC | No Connection | (1) |
| 8 | N.C. | No Connection | (1) |
| 9 | GND | Ground | |
| 10 | RxAo- | Third pixel, Negative LVDS differential data input. Channel 0 | (4) |
| 11 | RxAo+ | Third pixel, Positive LVDS differential data input. Channel 0 | |
| 12 | RxBo- | Third pixel, Negative LVDS differential data input. Channel 1 | |
| 13 | RxBo+ | Third pixel, Positive LVDS differential data input. Channel 1 | |
| 14 | RxCo- | Third pixel, Negative LVDS differential data input. Channel 2 | |
| 15 | RxCo+ | Third pixel, Positive LVDS differential data input. Channel 2 | |
| 16 | GND | Ground | |
| 17 | RxClko- | Third pixel, Negative LVDS differential clock input. | |
| 18 | RxClko+ | Third pixel, Positive LVDS differential clock input. | |
| 19 | GND | Ground | |
| 20 | RxDo- | Third pixel, Negative LVDS differential data input. Channel 3 | |
| 21 | RxDo+ | Third pixel, Positive LVDS differential data input. Channel 3 | |
| 22 | RxEo- | Third pixel, Negative LVDS differential data input. Channel 4 | |
| 23 | RxEo+ | Third pixel, Positive LVDS differential data input. Channel 4 | |
| 24 | NC | No Connection | (1) |
| 25 | NC | No Connection | (1) |
| 26 | RxAe- | Fourth pixel, Negative LVDS differential data input. Channel 0 | (4) |
| 27 | RxAe+ | Fourth pixel, Positive LVDS differential data input. Channel 0 | |
| 28 | RxBe- | Fourth pixel, Negative LVDS differential data input. Channel 1 | |
| 29 | RxBe+ | Fourth pixel, Positive LVDS differential data input. Channel 1 | |
| 30 | RxCe- | Fourth pixel, Negative LVDS differential data input. Channel 2 | |
| 31 | RxCe+ | Fourth pixel, Positive LVDS differential data input. Channel 2 | |
| 32 | GND | Ground | |
| 33 | RxClke- | Fourth pixel, Negative LVDS differential clock input. | |
| 34 | RxClke+ | Fourth pixel, Positive LVDS differential clock input. | |
| 35 | GND | Ground | |
| 36 | RxDe- | Fourth pixel, Negative LVDS differential data input. Channel 3 | (4) |
| 37 | RxDe+ | Fourth pixel, Positive LVDS differential data input. Channel 3 | |
| 38 | RxEe- | Fourth pixel, Negative LVDS differential data input. Channel 4 | |
| 39 | RxEe+ | Fourth pixel, Positive LVDS differential data input. Channel 4 | |
| 40 | N.C. | No Connection | (1) |
| 41 | N.C. | No Connection | (1) |

Note (1) Please be reserved to open.

Note (2) Low or Open : VESA LVDS Format (default), High : JEIDA Format.

Note (3) Low =Open or Connect to GND, High = Connect to +3.3V

Note (4) LVDS 4-Port Data Mapping



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| Port | CH of LVDS | Data Stream |
|---|---|---|
| 1st Port | First pixel | 1, 5, 9, ....., 1913, 1917 |
| 2nd Port | Second pixel | 2, 6, 10, ....., 1914, 1918 |
| 3rd Port | Third pixel | 3, 7, 11, ....., 1915, 1919 |
| 4th Port | Fourth pixel | 4, 8, 12, ....., 1916, 1920 |

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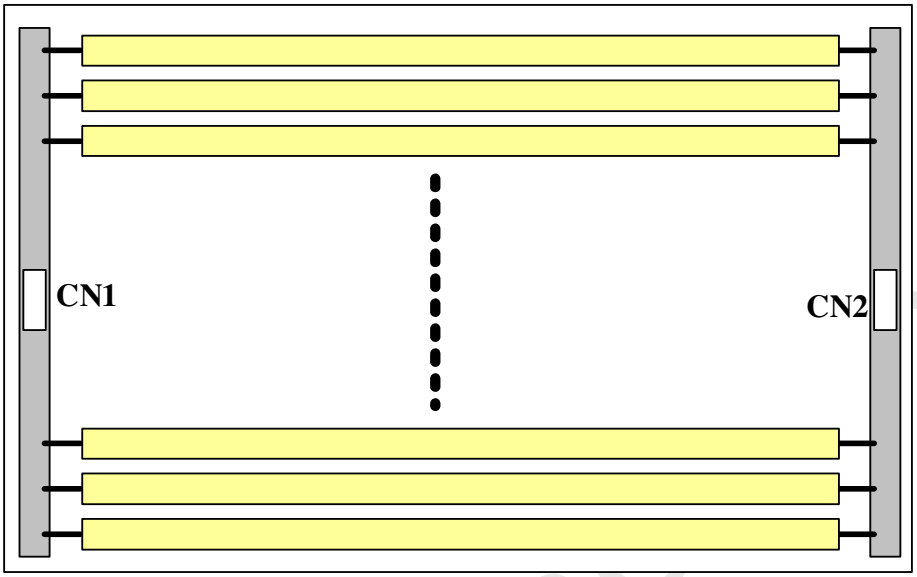
### 5.2 BACKLIGHT UNIT

CN1-CN2: 65002WR-03.

| Pin | Symbol | Description |
|---|---|---|
| 1 | H.V. | High Voltage for Backlight Unit |
| 2 | H.V. | High Voltage for Backlight Unit |
| 3 | N.C. | No Connection |

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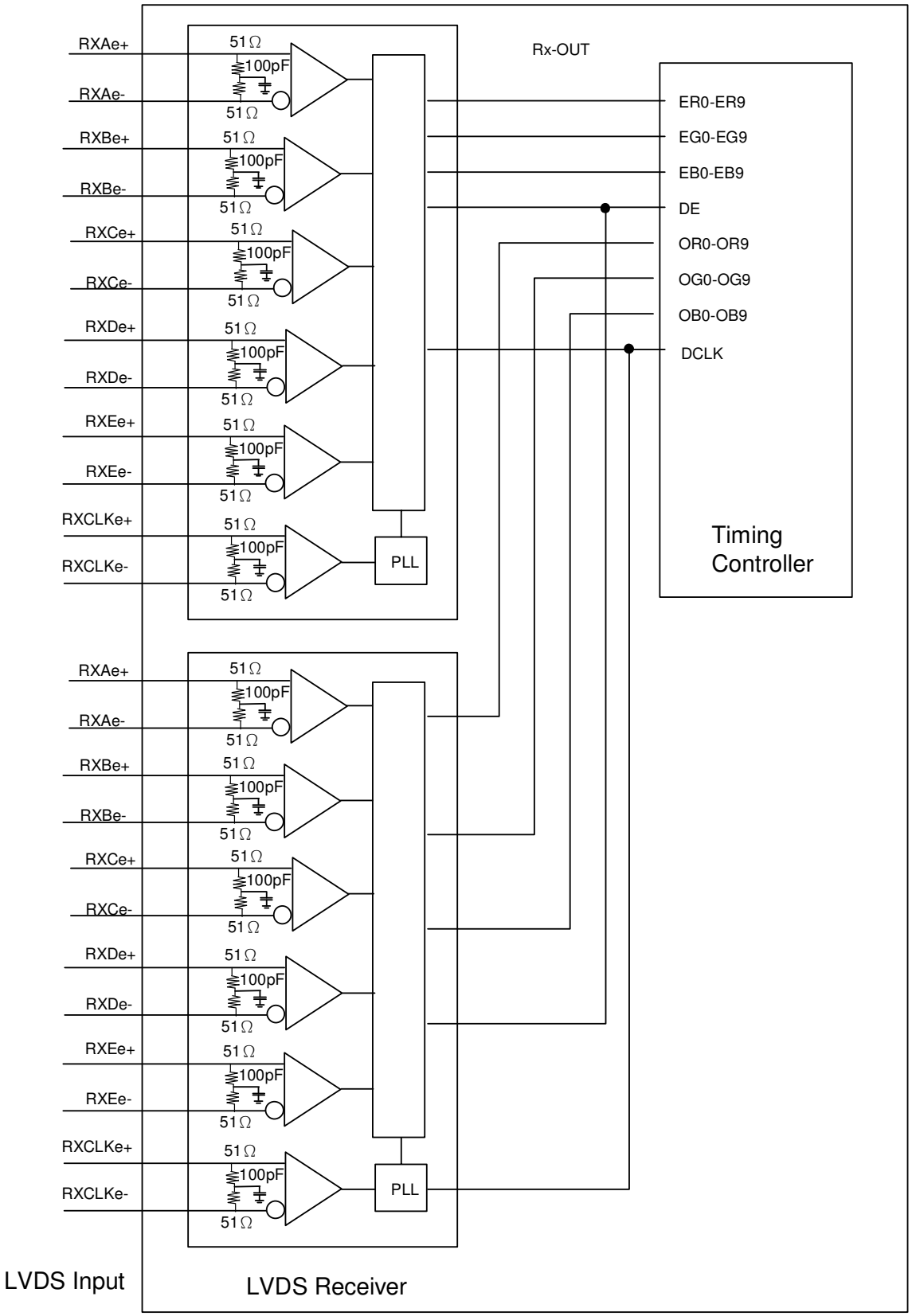
## 5.3 BLOCK DIAGRAM OF INTERFACE



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ER0~ER9 : Even pixel R data
EG0~EG9 : Even pixel G data
EB0~EB9 : Even pixel B data
OR0~OR9 : Odd pixel R data
OG0~OG9 : Odd pixel G data
OB0~OB9 : Odd pixel B data
DE : Data enable signal
DCLK : Data clock signal

Notes: (1) The system must have the transmitter to drive the module.
(2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

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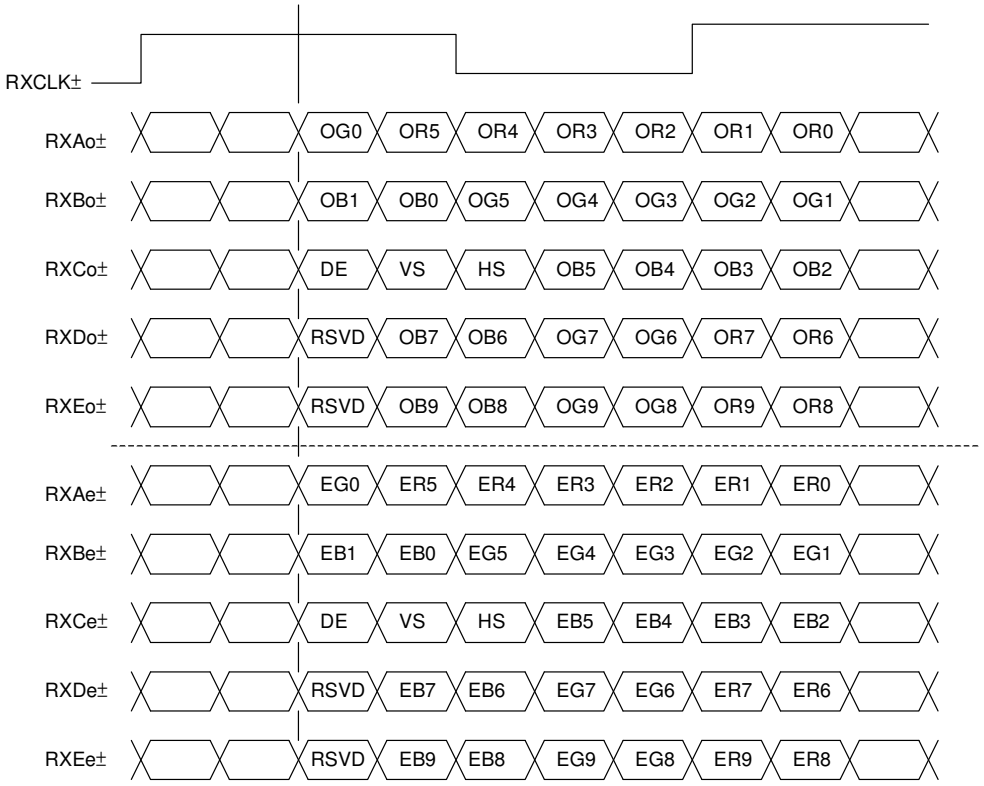
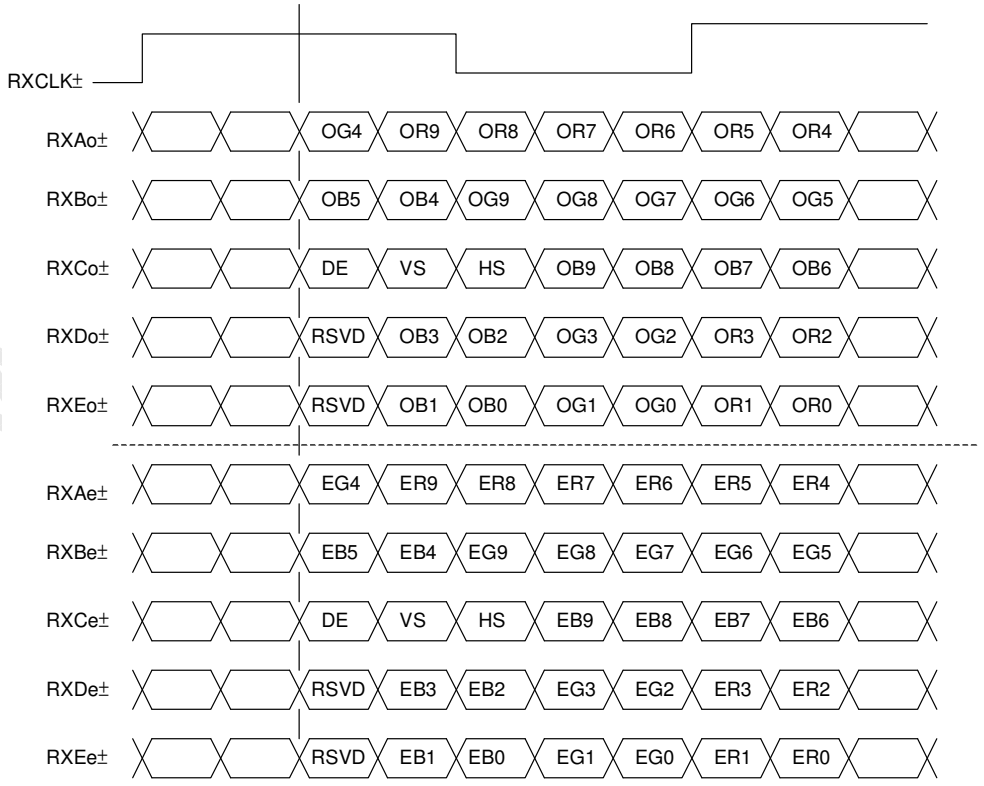
### 5.4 LVDS INTERFACE

SELLVDS = L or Open




SELLVDS = H



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R0~R9: Pixel R Data (9; MSB, 0; LSB)

G0~G9: Pixel G Data (9; MSB, 0; LSB)

B0~B9: Pixel B Data (9; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

RSVD : Reserved.

## 5.5 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 10-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | | | | | Green | | | | | | | | | | Blue | | | | | | | | | |
| | | R9 | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G9 | G8 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B9 | B8 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Red (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red (1021) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1022) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1023) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green (1021) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1022) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue (1021) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue (1022) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue (1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage



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## 6. INTERFACE TIMING

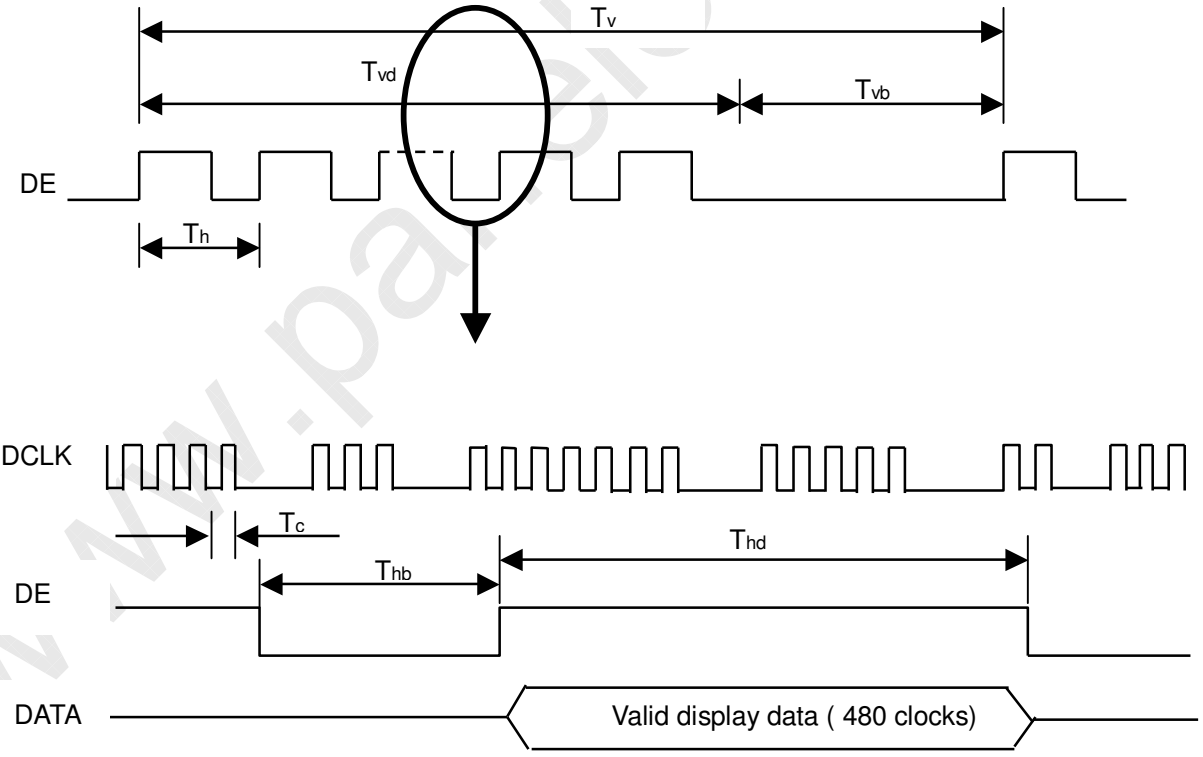
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| LVDS Receiver Clock | Frequency | 1/Tc | 60 | 74.25 | 80 | MHz | =297/4 |
| | Input cycle to cycle jitter | Trcl | - | - | 200 | ps | - |
| LVDS Receiver Data | Setup Time | Tlvsu | 600 | - | - | ps | |
| | Hold Time | Tlvhd | 600 | - | - | ps | |
| Vertical Active Display Term | Frame Rate | Fr | | 120 | | Hz | |
| | Total | Tv | 1115 | 1125 | 1139 | Th | Tv=Tvd+Tvb |
| | Display | Tvd | 1080 | 1080 | 1080 | Th | - |
| | Blank | Tvb | 35 | 45 | 59 | Th | - |
| Horizontal Active Display Term | Total | Th | 540 | 550 | 575 | Tc | Th=Thd+Thb |
| | Display | Thd | 480 | 480 | 480 | Tc | - |
| | Blank | Thb | 45 | 70 | 95 | Tc | - |

Note (1) Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally..

**INPUT SIGNAL TIMING DIAGRAM**



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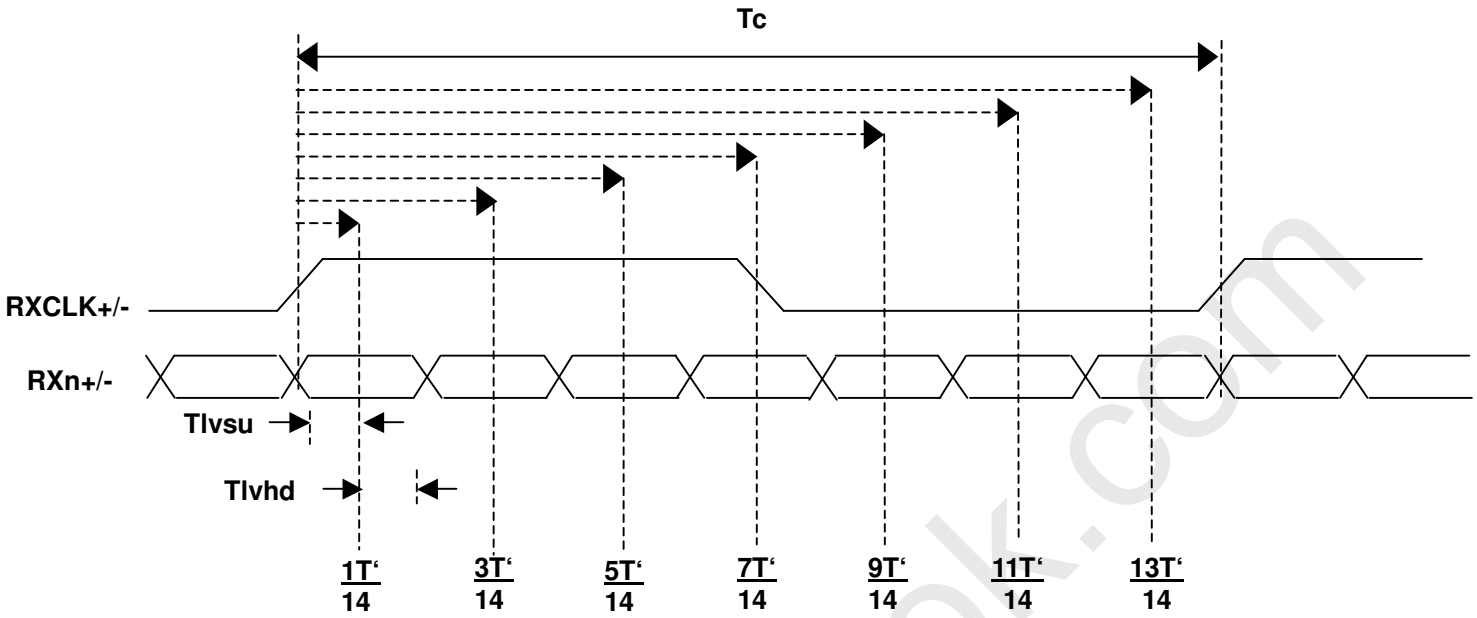
## LVDS INPUT INTERFACE TIMING DIAGRAM

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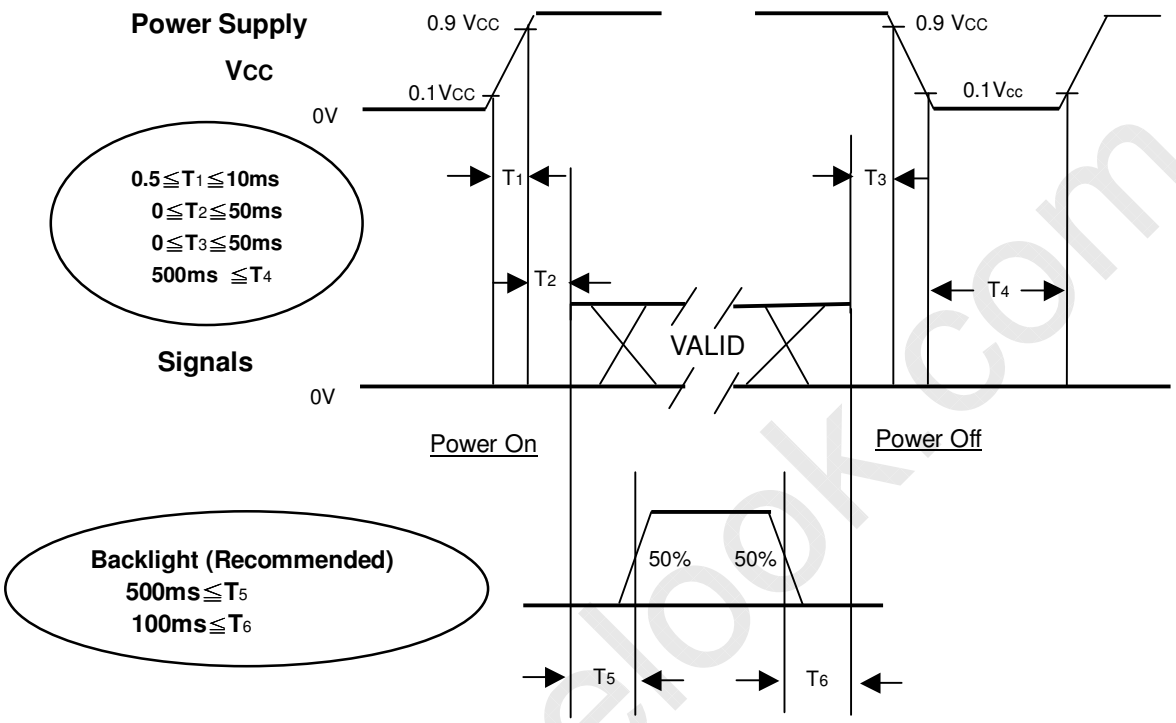
### 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the diagram below.




**Power ON/OFF Sequence**

Note.

(1) The supply voltage of the external system for the module input should follow the definition of Vcc.

(2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

(3) In case of VCC is in off level, please keep the level of input signals on the low or high impedance.

(4) T4 should be measured after the module has been fully discharged between power off and on period.

Interface signal shall not be kept at high impedance when the power is on.



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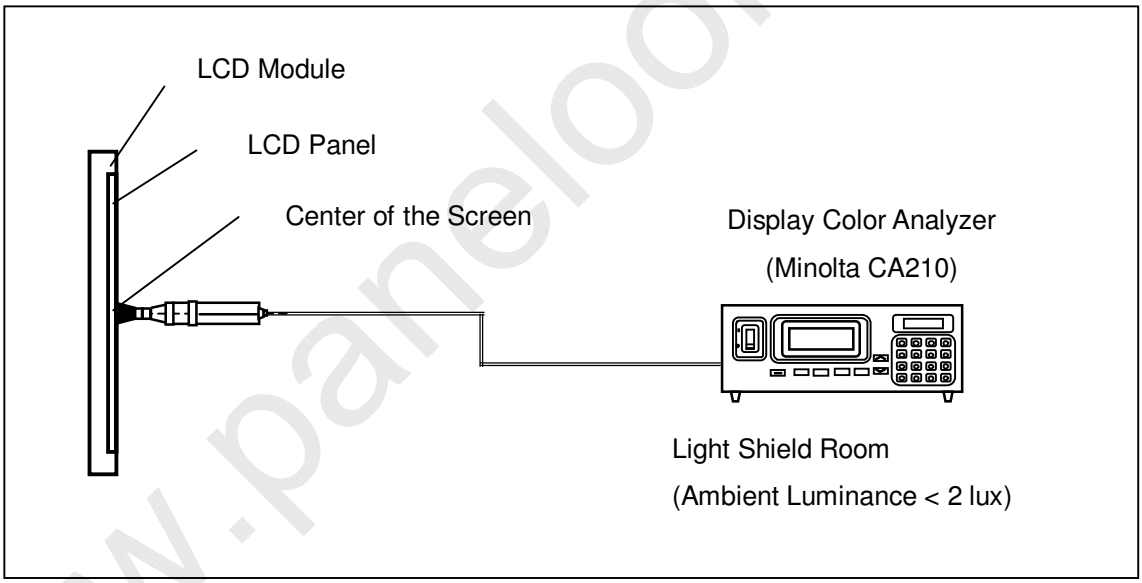
## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | oC |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | VCC | 12 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Lamp Current | IL | 125±10 | mA |
| Oscillating Frequency (Inverter) | FW | 45±2 | KHz |
| Vertical Frame Rate | Fr | 100 | Hz |

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.

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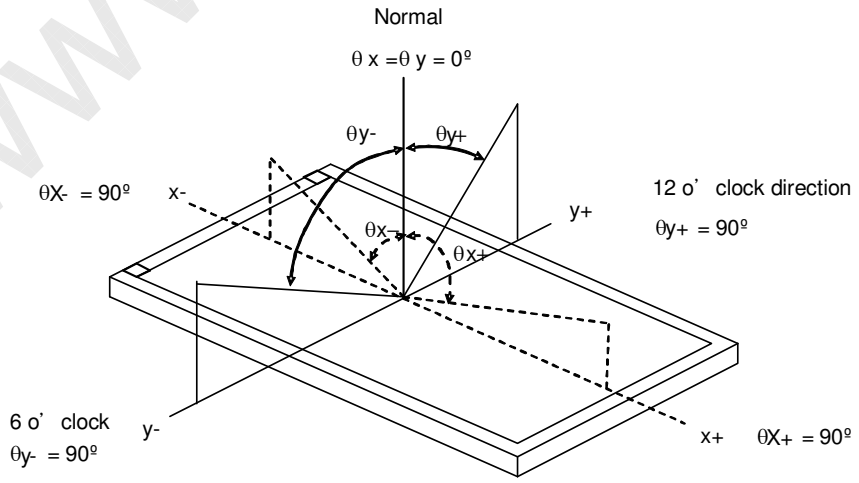
## 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | θx=0°, θy =0° Viewing angle at normal direction | (1800) | (2000) | | - | Note (2) |
| Response Time | | Gray to gray | | | (4.0) | (8.0) | ms | Note (3) |
| Center Luminance of White | | LC | | (400) | (500) | | $cd/m^2$ | Note (4) |
| White Variation | | δW | | | | (1.3) | - | Note (7) |
| Cross Talk | | CT | | | | (4) | % | Note (5) |
| Color Chromaticity | Red | Rx | | Typ. -0.03 | (0.638) | Typ. +0.03 | - | Note (6) |
| | | Ry | | | (0.331) | | - | |
| | Green | Gx | | | (0.268) | | - | |
| | | Gy | | | (0.593) | | - | |
| | Blue | Bx | | | (0.143) | | - | |
| | | By | | | (0.068) | | - | |
| | White | Wx | | | (0.280) | | - | |
| | | Wy | | | (0.285) | | - | |
| | Color Gamut | C.G | | (70) | (72) | | % | NTSC |
| Viewing Angle | Horizontal | θx+ | CR≥20 | 80 | 88 | | Deg. | Note (1) |
| | | θx- | | 80 | 88 | | | |
| | Vertical | θY+ | | 80 | 88 | | | |
| | | θY- | | 80 | 88 | | | |

Note (1) Definition of Viewing Angle (θx, θy):

Viewing angles are measured by Eldim EZ-Contrast 160R



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Note (2) Definition of Contrast Ratio (CR):

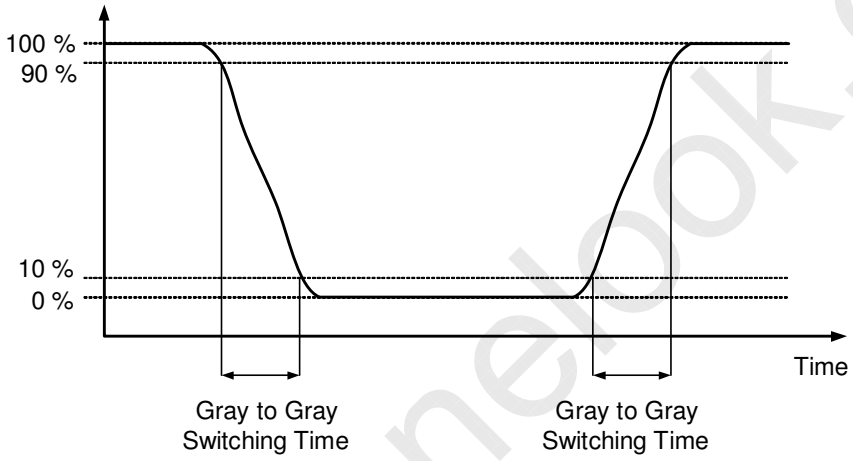
The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Gray-to-Gray Switching Time:

**Optical Response**




The driving signal means the signal of luminance 0%, 20%, 40%, 60%, 80%, 100%.

Gray to gray average time means the average switching time of luminance 0%, 20%, 40%, 60%, 80%, 100% to each other.

Note (4) Definition of Luminance of White (LC, LAVE):

Measure the luminance of gray level 255 at center point and 5 points

LC = L (5), where L (X) is corresponding to the luminance of the point X at the figure in Note (7).

Note (5) Definition of Cross Talk (CT):

CT = | YB – YA | / YA × 100 (%)

Where:

YA = Luminance of measured location without gray level 0 pattern (cd/m2)

YB = Luminance of measured location with gray level 0 pattern (cd/m2)

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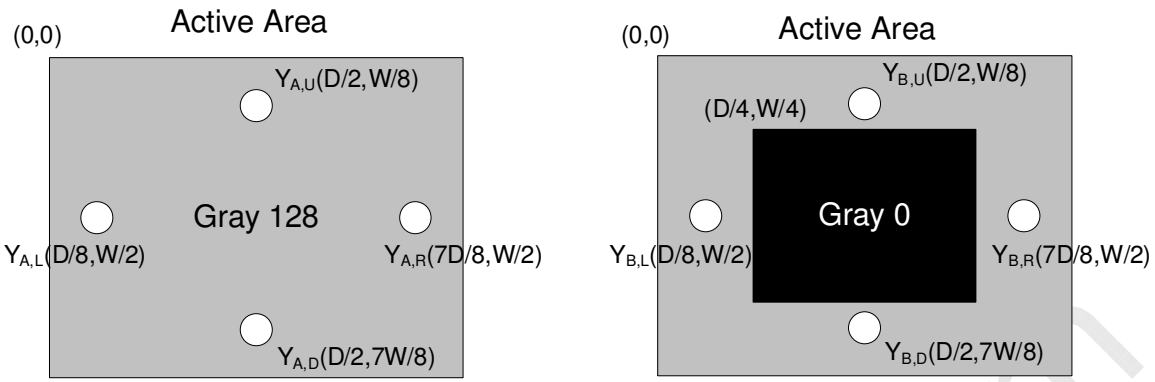
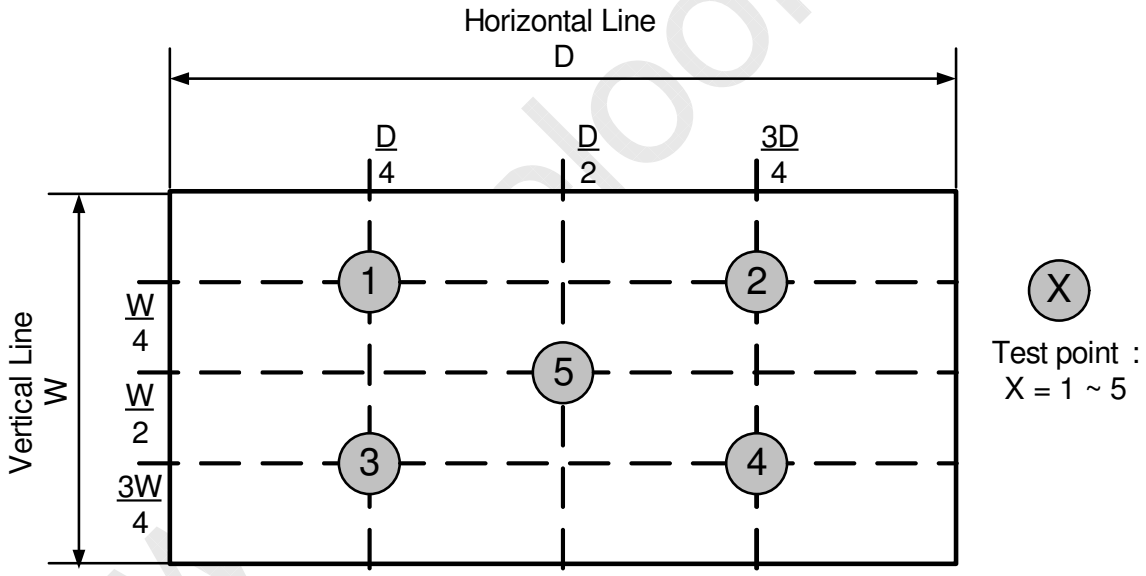



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



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## 8. PRECAUTIONS

### 8.1 ASSEMBLY AND HANDLING PRECAUTIONS

[ 1 ] Do not apply rough force such as bending or twisting to the module during assembly.

[ 2 ] It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

[ 3 ] Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.

[ 4 ] Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

[ 5 ] Do not plug in or pull out the I/F connector while the module is in operation.

[ 6 ] Do not disassemble the module.

[ 7 ] Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

[ 8 ] Moisture can easily penetrate into LCD module and may cause the damage during operation.

[ 9 ] When storing modules as spares for a long time, the following precaution is necessary.

[ 9.1 ] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃at normal humidity without condensation.

[ 9.2 ] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

[ 10 ] When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

### 8.2 SAFETY PRECAUTIONS

[ 1 ] The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.

[ 2 ] If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

[ 3 ] After the module's end of life, it is not harmful in case of normal operation and storage.



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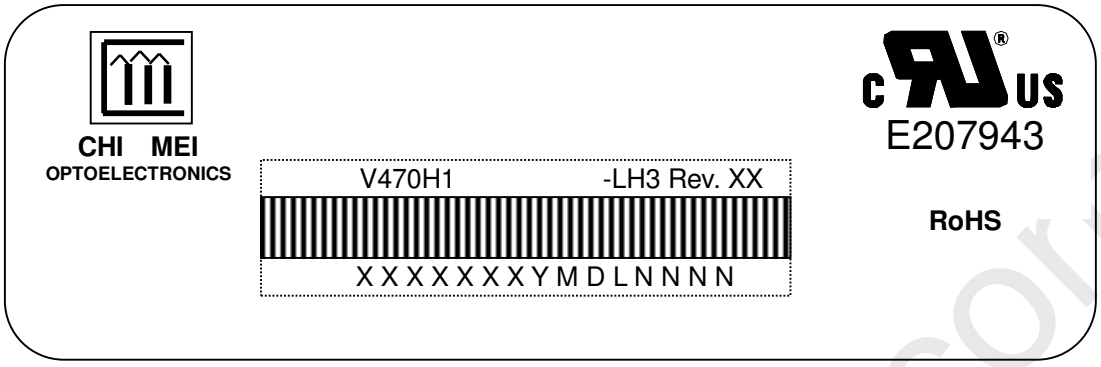
## 9. DEFINITION OF LABELS

### 9.1 CMO MODULE LABEL

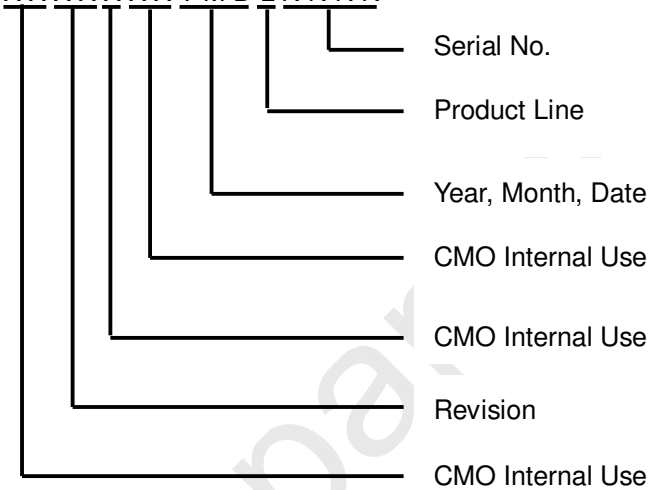
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.




Model Name: V470H1-LH3

Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

Serial ID: X X X X X X Y M D L N N N N




Serial ID includes the information as below:

Manufactured Date:

Year: 0~9, for 2000~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

Revision Code: Cover all the change

Serial No.: Manufacturing sequence of product

Product Line: 1 -> Line1, 2 -> Line 2, …etc.



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## 10. PACKAGING

### 10.1 PACKAGING SPECIFICATIONS

3 LCD TV modules / 1 Box

Box dimensions: 1190(L) X 280 (W) X 720(H)

Weight: approximately 52Kg (3 modules per box)

### 10.2 PACKAGING METHOD

Figures 10-1 and 10-2 are the packing method.

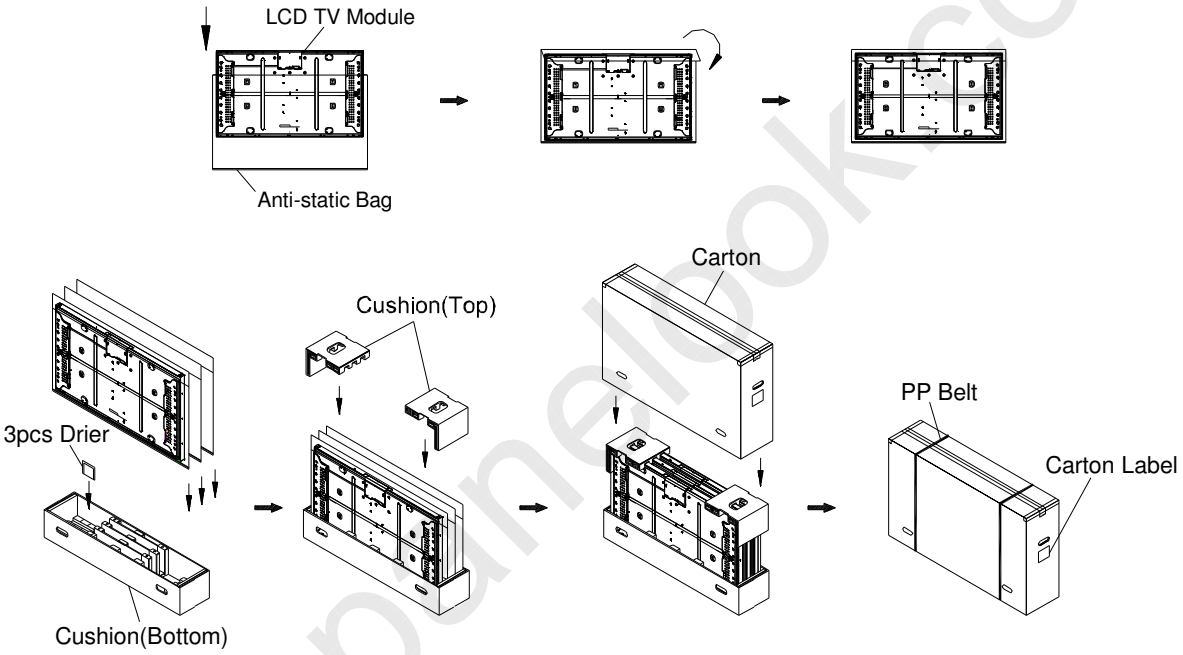


Figure.10-1 packing method

Figure.10-2 Packing method



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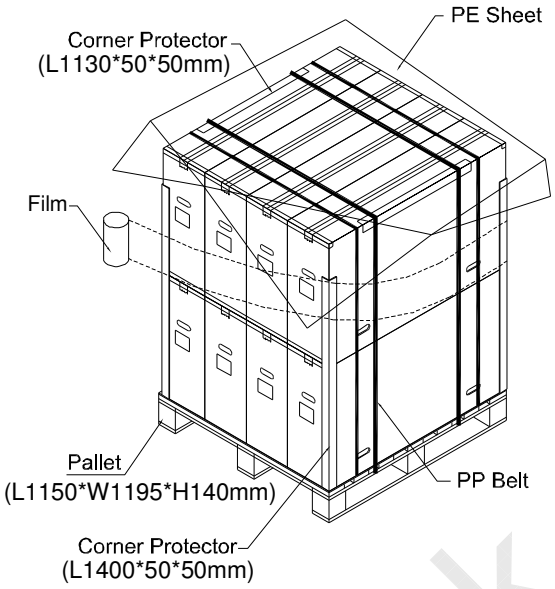
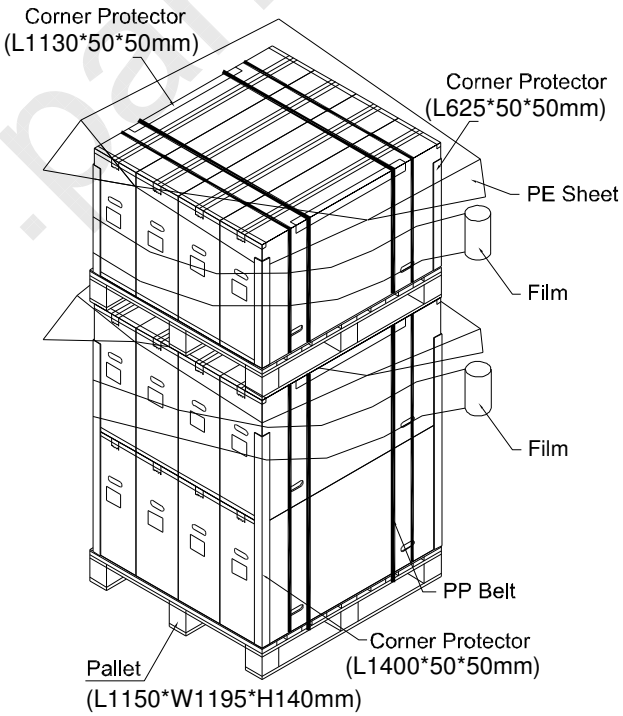



Sea / Land Transportation (40ft HQ Container)

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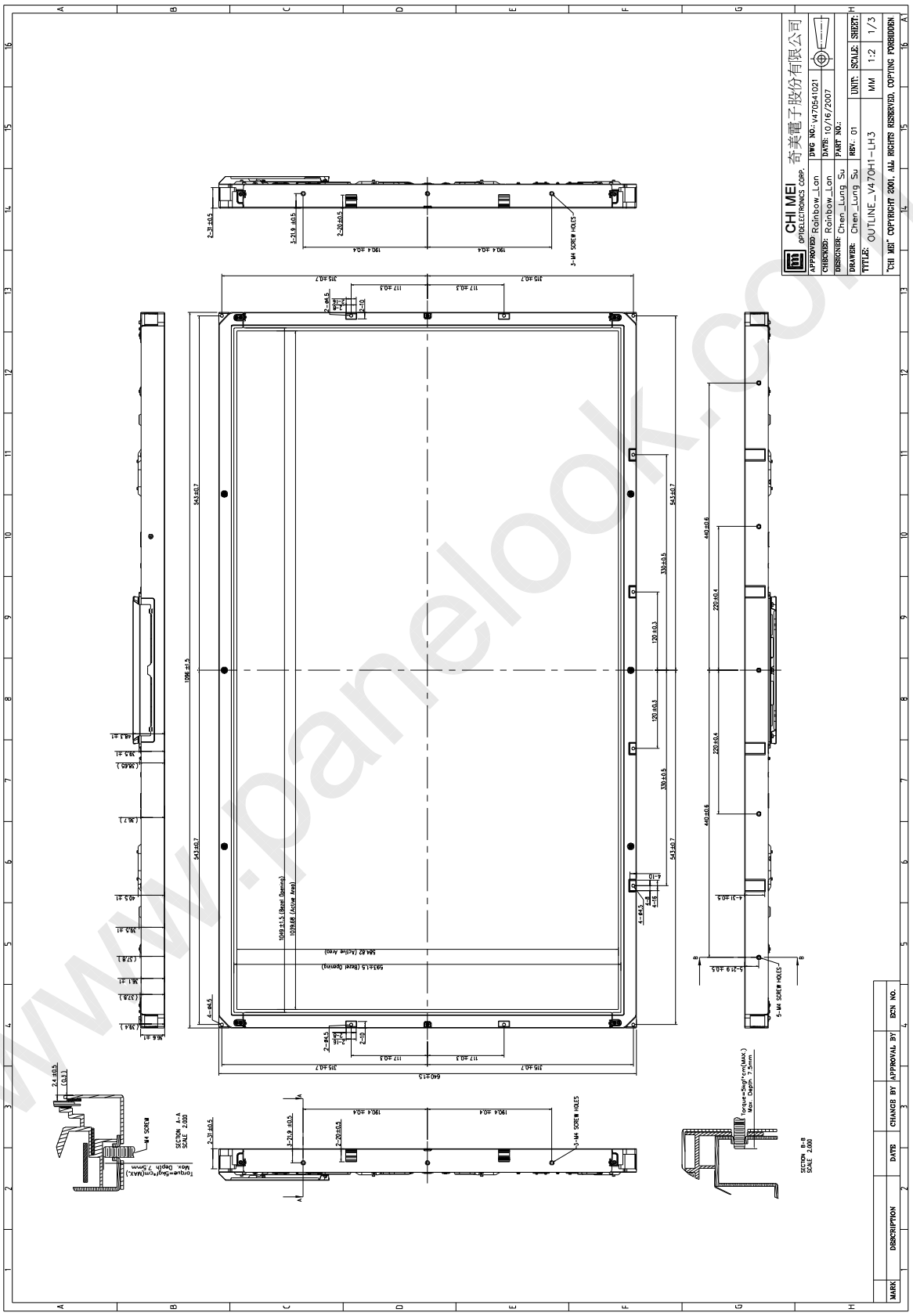
## 11. MECHANICAL CHARACTERISTICS

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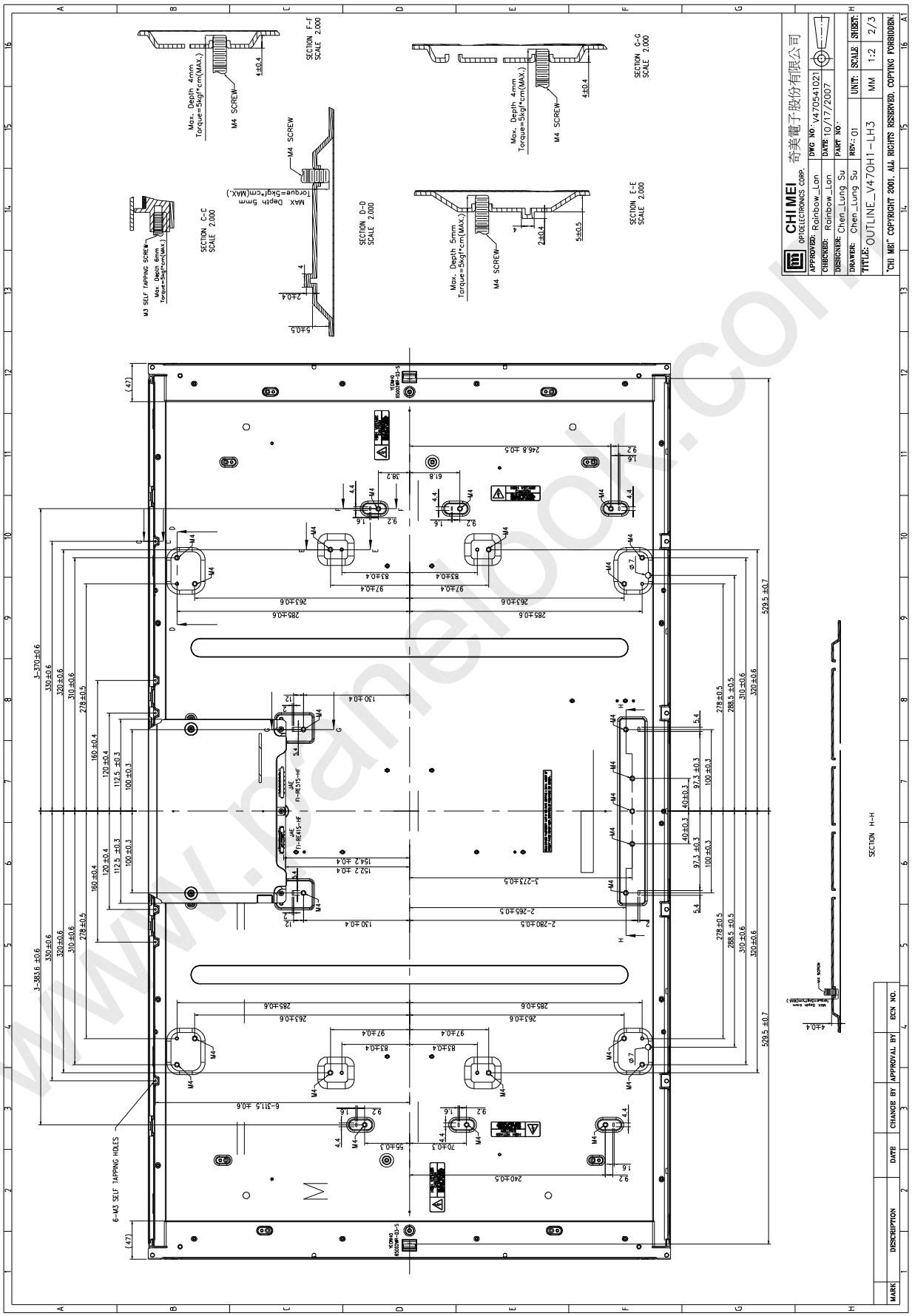


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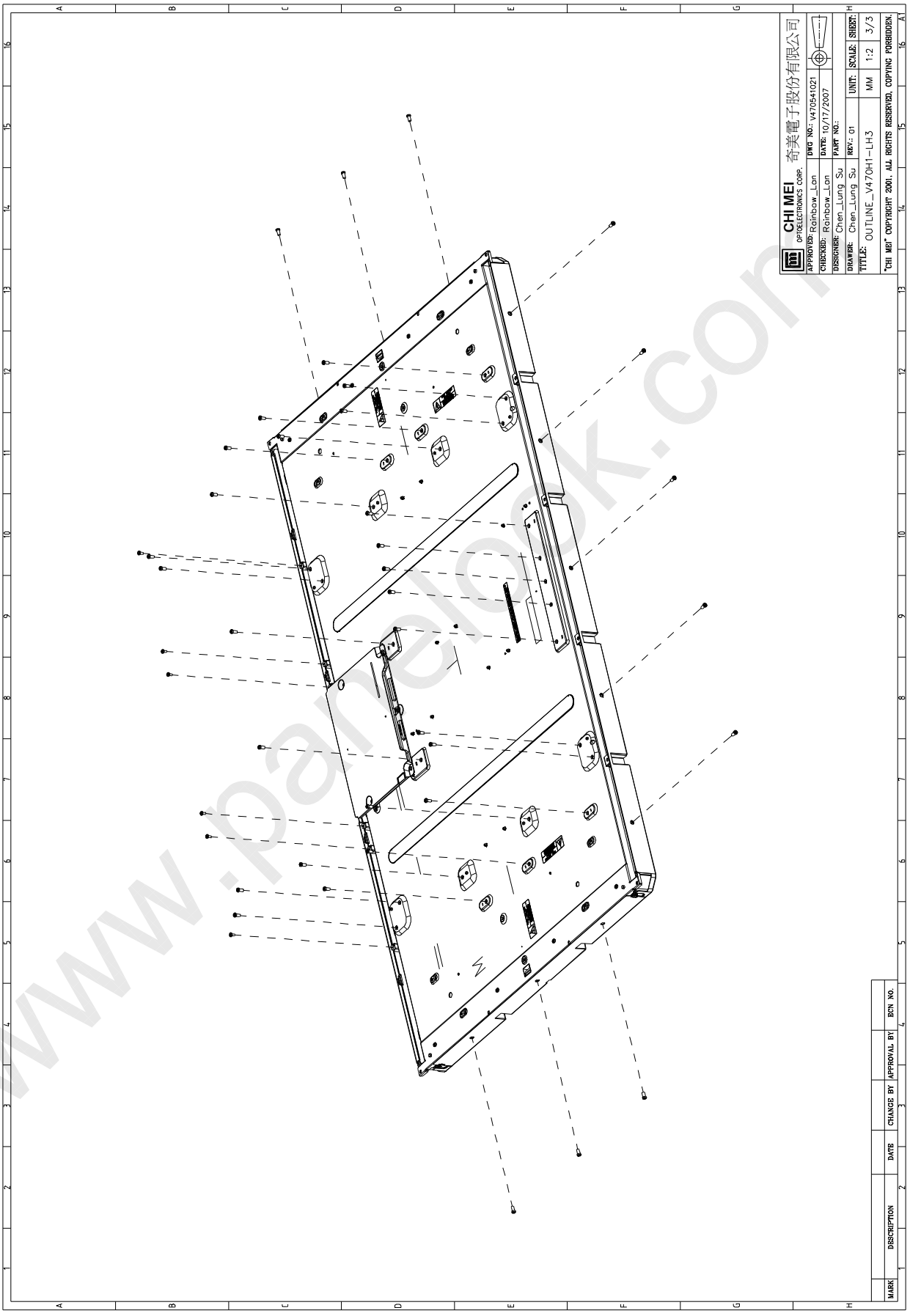


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